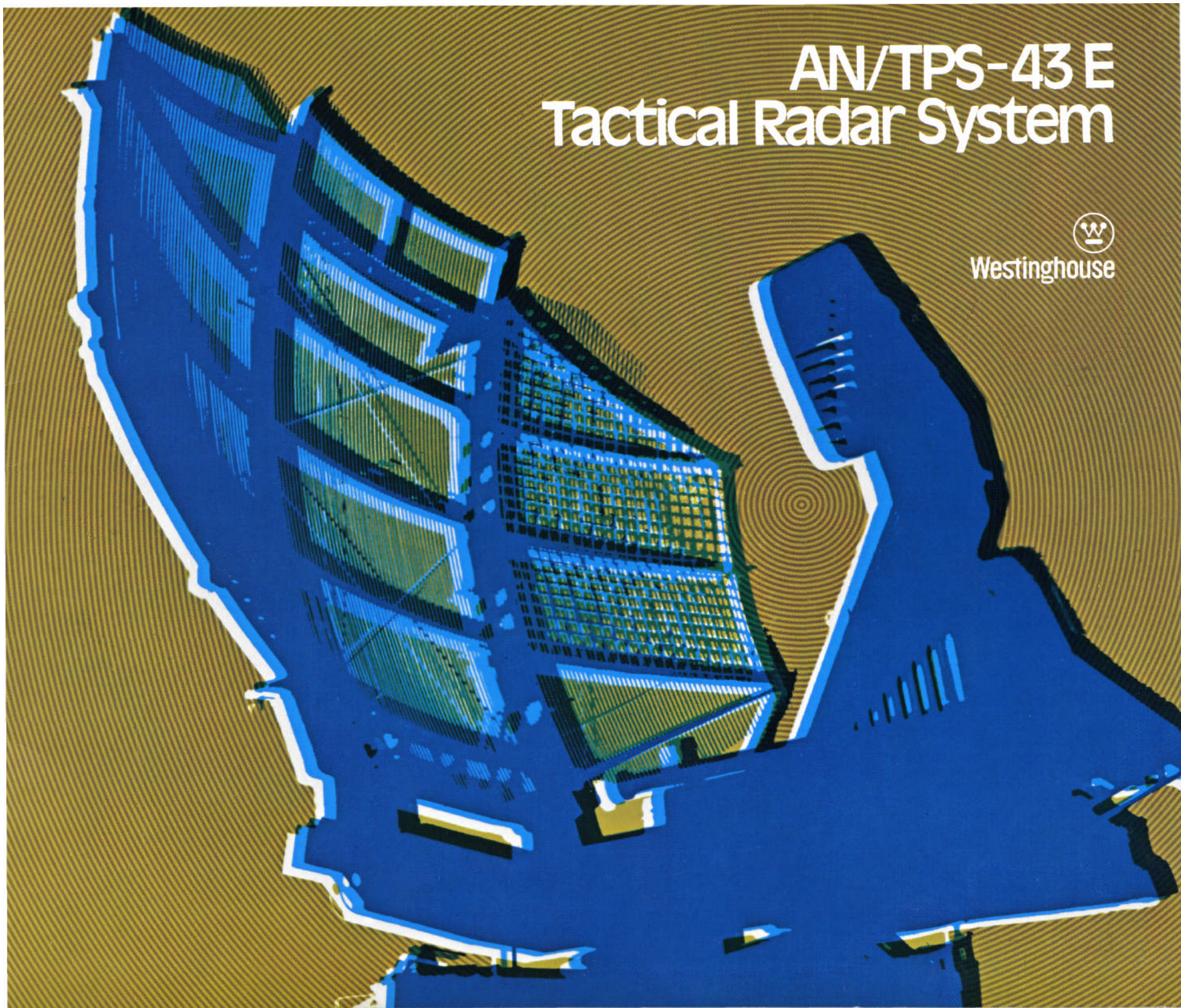


AN/TPS-43 E Tactical Radar System



Westinghouse



The AN/TPS-43 Story

Force asked industry to design a radar which would fulfill a unique set of requirements. In essence, the USAF said: Build a new radar which will give us reliable long-range, three-dimensional performance comparable to that found typically in large fixed station sets, PLUS the rapid transportability, set-up, and disassembly traditionally limited to tactical radars. In short, give us a radar which balances performance and mobility.

Westinghouse designed the AN/TPS-43 to meet and exceed this stringent, and sometimes technically conflicting, set of specifications. The production record of the AN/TPS-43 is testimony to the wisdom of the USAF's design philosophy.

Today, we are producing more TPS-43 radars than ever before. At this writing, a total of 106 radar sets have been ordered by 12 nations. Half of this total are for the new "E" model. The USAF alone has reordered the TPS-43 three times.

The "E" model's design is the latest refinement of the USAF's philosophy. It is a unique blend of improvements based on experience gained from thousands of hours of field deployment and battlefield use, and the incorporation of modern digital and solid state techniques.

The AN/TPS-43E is presented in detail on the pages which follow.

Field proven: A Cost-effective Tactical 3-D Radar System

- **MOBILITY**
- **MAINTAINABILITY**
- **RELIABILITY**
- **PERFORMANCE**

The AN/TPS-43E radar system is a long-range, field-proven tactical radar currently being built for the U.S. Air Force and several other countries.

This radar detects high speed, low-flying aircraft and provides three-dimensional (range, azimuth and height) data for aircraft tracking and intercept control. The AN/TPS-43E can provide autonomous aircraft surveillance and control. It can also be interfaced with manual or automated command and control systems.

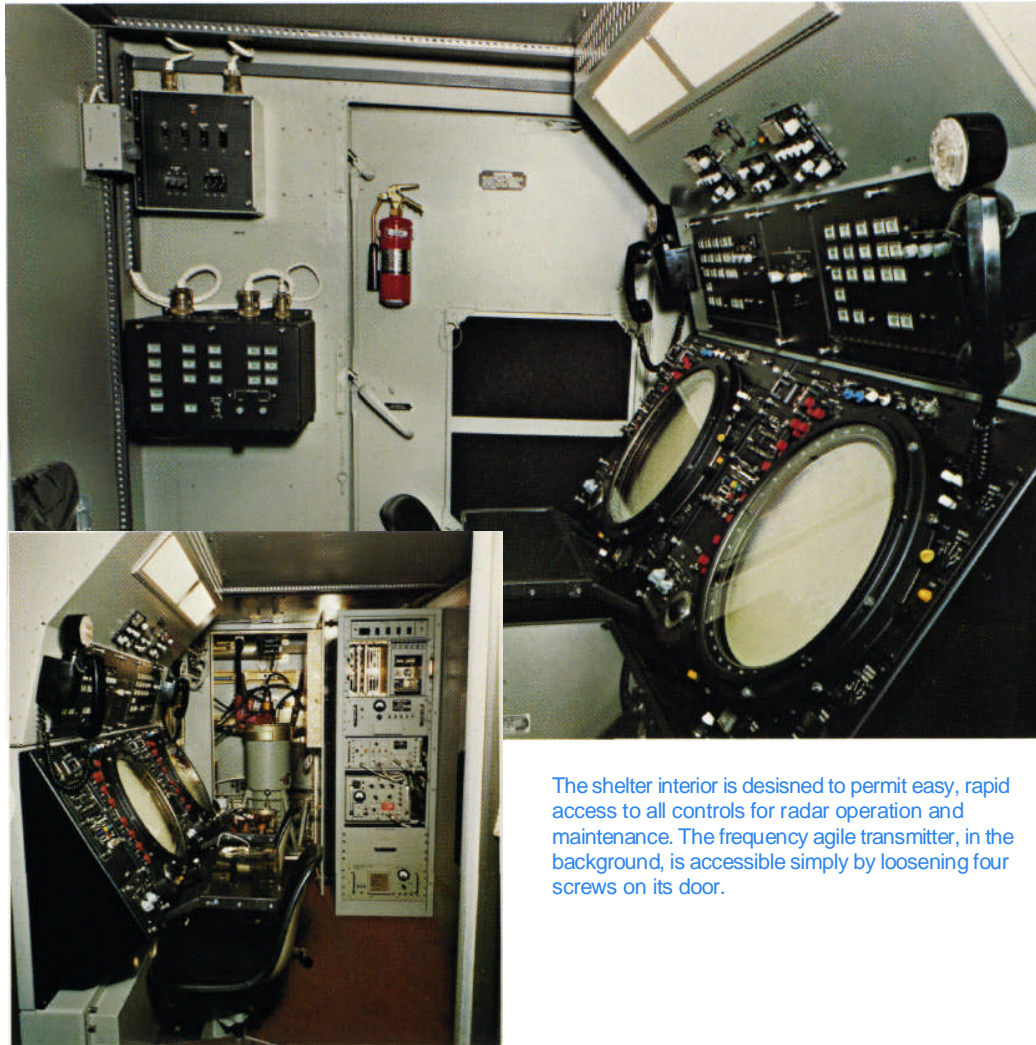
The AN/TPS-43E began its expected long-term service life in 1977 with the USAF and other users.



Autonomous Operation

The AN/TPS-43E system consists of two completely self-contained packages: an operations/radar electronics shelter and an antenna pallet.

The radar shelter's built-in operations capability enables the AN/TPS-43E to serve as an autonomous air surveillance and control site. This shelter houses two complete operator positions. Each position contains an AN/UPA-62 display console for aircraft track and intercept control, an AN/UPA-59 active and passive decoder which provides IFF/SIF (identification friend or foe/selective identification feature) information, and a digital height readout unit to pinpoint individual target height. Each position also has ground-to-air and ground-to-ground communications equipment.



The shelter interior is designed to permit easy, rapid access to all controls for radar operation and maintenance. The frequency agile transmitter, in the background, is accessible simply by loosening four screws on its door.

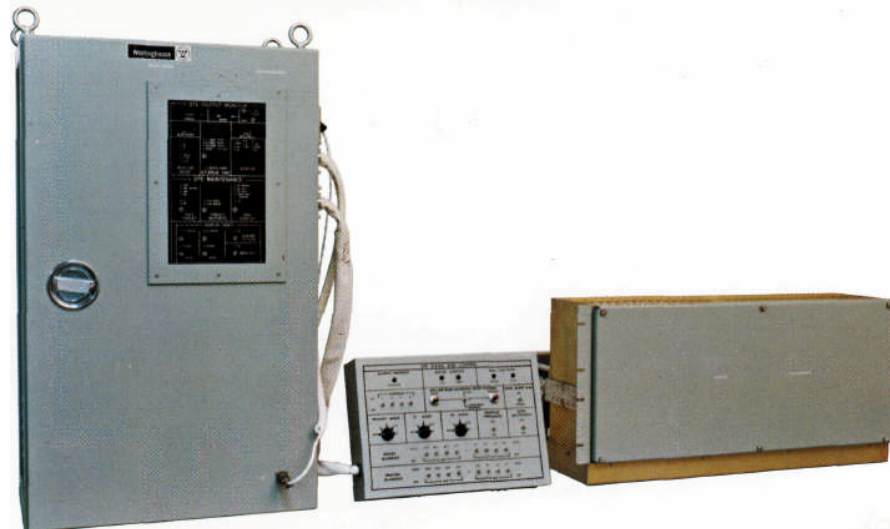
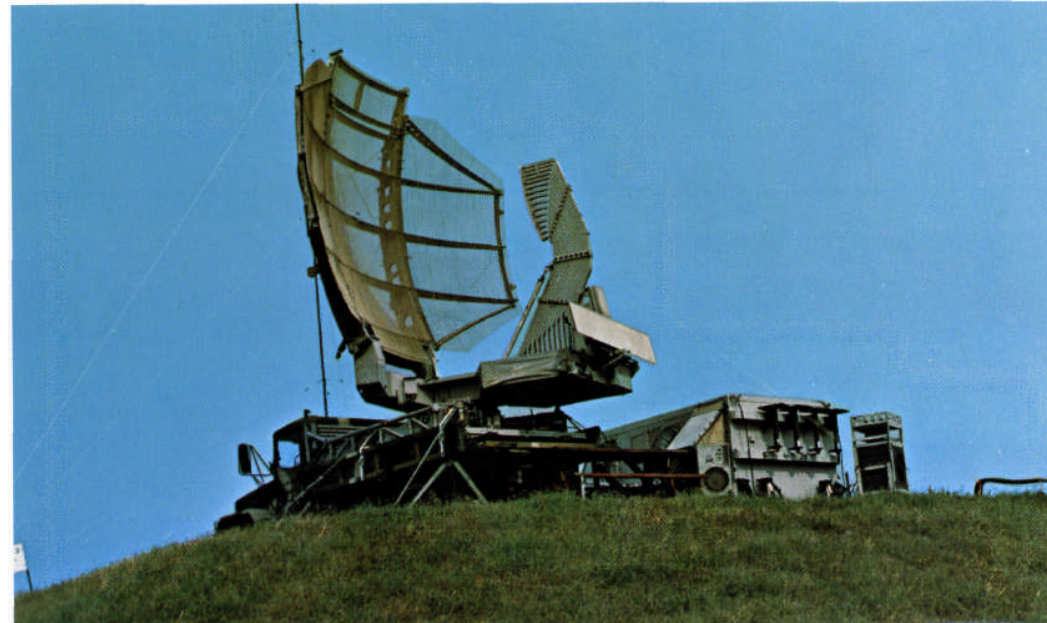


Remoted Operation

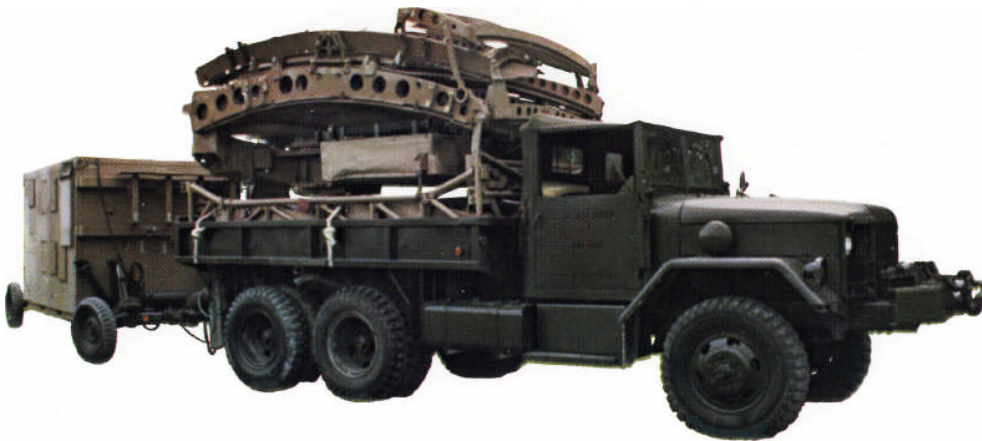
Westinshouse can also incorporate a disital target extractor (DTE) which provides an interface with an automated air surveillance and control system. The DTE correlates ranse, azimuth, heisht and IFF data and transforms radar signals into concise plot messases which can be transmitted over telephone lines or radio channels to an associated operations center located miles from the antenna.

The use of a DTE also allows radar nettins where data from several AN/TPS-43E's can be transmitted to a central command and control center. This capability reduces site manning requirements, and places the decision-making process at a higher echelon where data from several radars can be correlated into an overall air defense system.

The AN/TPS-43E provides analog data for use with manual display and operations procedures, and provides digital outputs for digital data processing, storage, and display. The radar is therefore compatible with most types of operations centers, from the simplest manual to the most sophisticated automated type.



Ample space is provided within the radar shelter for installation of all DTE equipment. The monitor and test panel (above left) is installed on the shelter's right wall behind the first operator position. The operator control panel (above center) is installed in the overhead console, and the DTE (above right) is installed in space provided below the radar signal processor unit.



Simple, Rapid Mobility

The self-contained antenna pallet consists of the antenna system and auxiliary equipment arranged in a highly mobile package. The antenna folds into a single unit suitable for all modes of military transport.

Both the radar equipment shelter and the antenna pallet can be transported by helicopter, truck, one C-130 cargo aircraft, or towed on mobilizers. Both are also equipped with skids, lifting rings, and leveling pads.

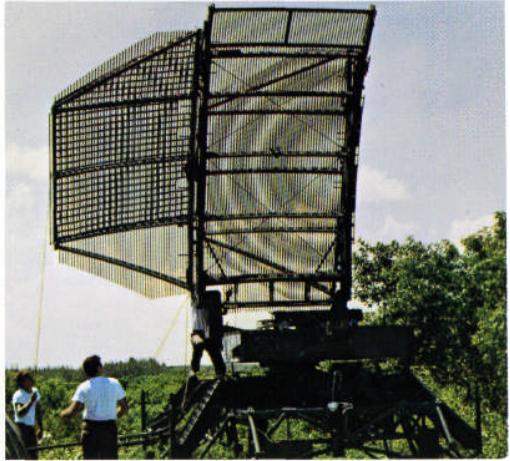
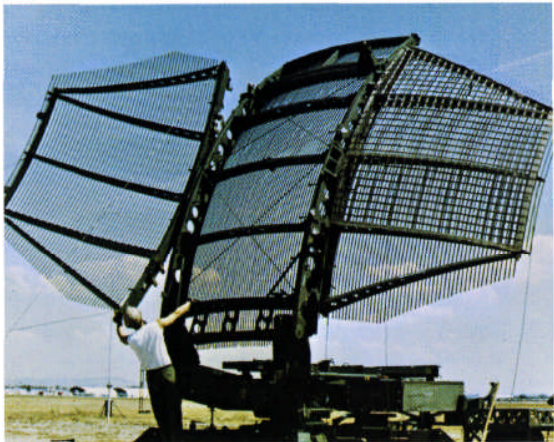
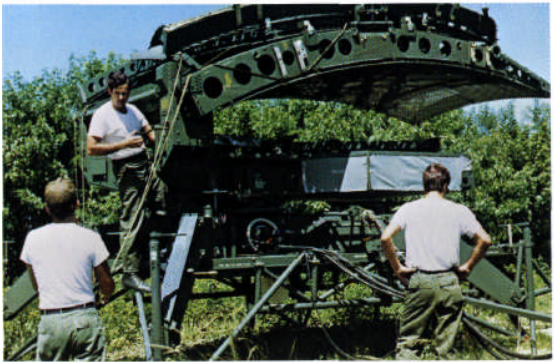
The AN/TPS-43E is highly survivable because its highly mobile configuration permits rapid dispersal, in turn lowering the radar system's vulnerability.

Once on site, the AN/TPS-43E can be totally operational in approximately one hour. Disassembly requires only 30 minutes.

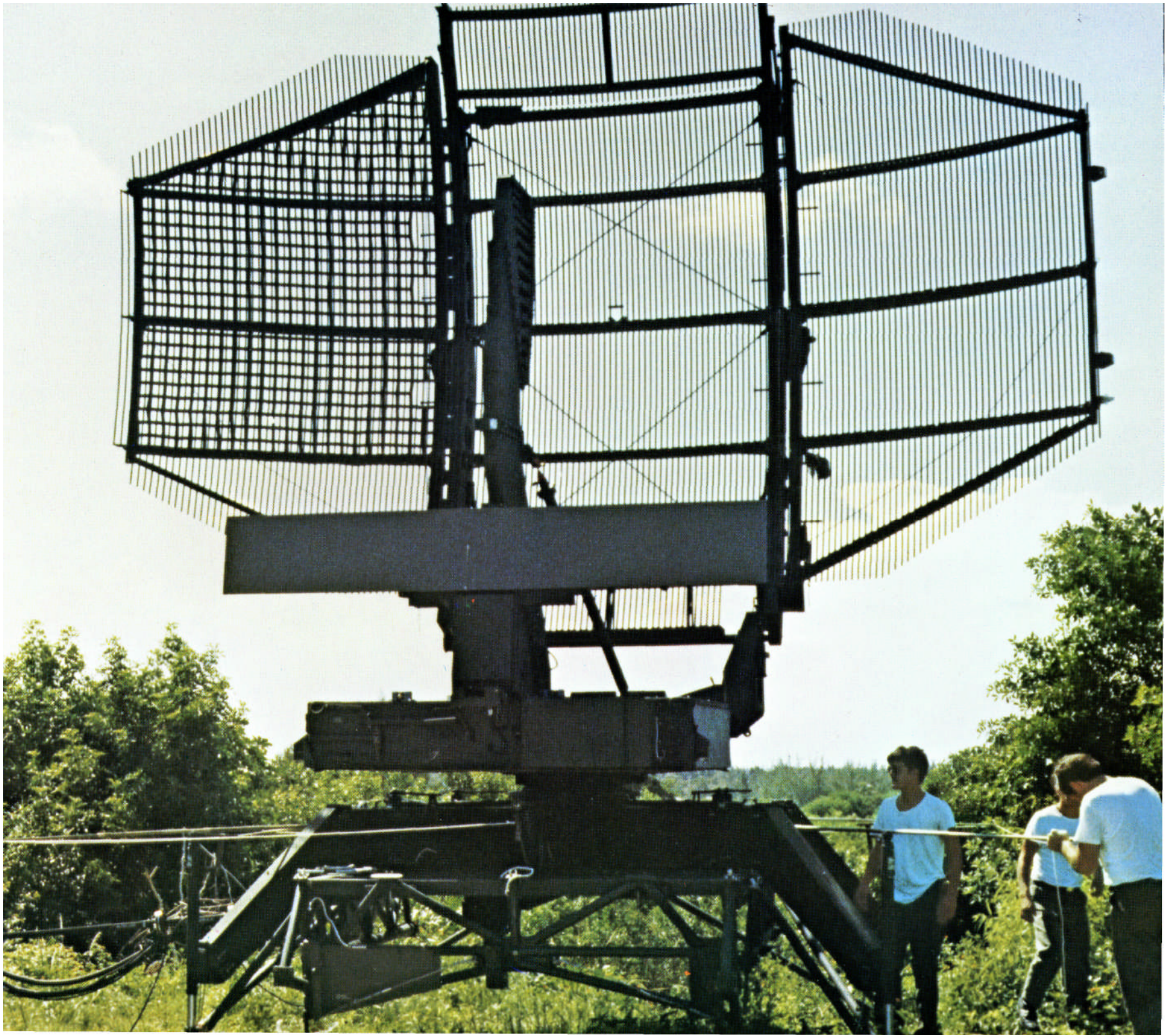
High Availability

The AN/TPS-43E is ready for use when needed. Tactical field experience has demonstrated a greater than 95 percent operational availability. Routine adjustments and preventive maintenance requirements have been minimized. Built-in fault isolation, plug-in replacement, and more than 200 hours mean-time-between-failure (MTBF) allow military technicians to maintain the radar without special site equipment.

Antenna Assembly



Once on site, the AN/TPS-43E can be totally operational in approximately one hour. Each step requires only two men with no special tools or lifting equipment. The reflector is raised (1 & 2) using built-in gears. Next, the two side panels are unfolded (3, 4 and 5), rotated, and locked into place. The feed array (6) installs by lifting and latching into its operating position and attaching a supporting brace on each side. The IFF antenna (7) and small radar reference antenna are similarly installed.



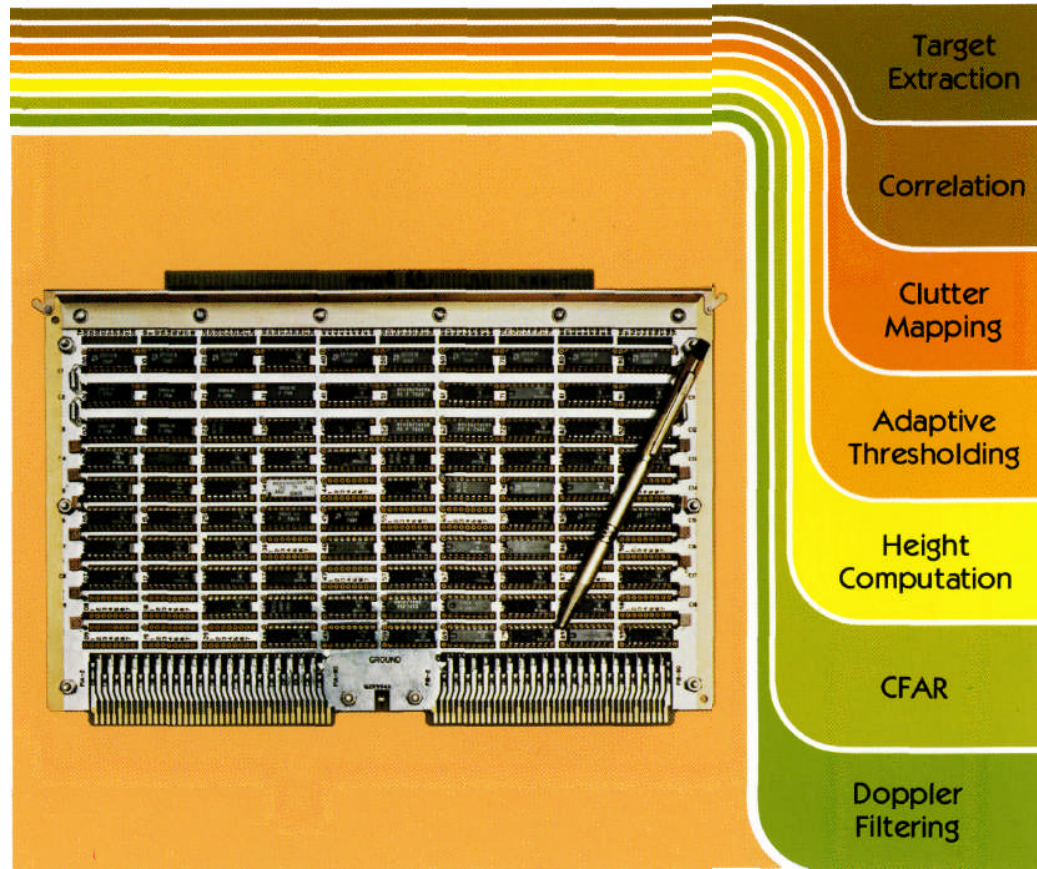
Field Experience Nets Design improvements

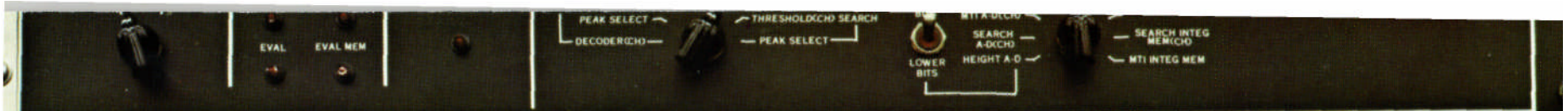
Data collected from thousands of hours of operational field deployment have provided Westinshouse with useful information to implement desin improvements in the "E" model. The net result has been a tactical radar which balances high performance, versatile operational capability and low life cycle cost.

For example, Westinghouse implemented digital signal processing and microwave integrated circuits in designing and packaging the radar receiver, moving target indication (MTI) unit, and signal processor (shown on far right).

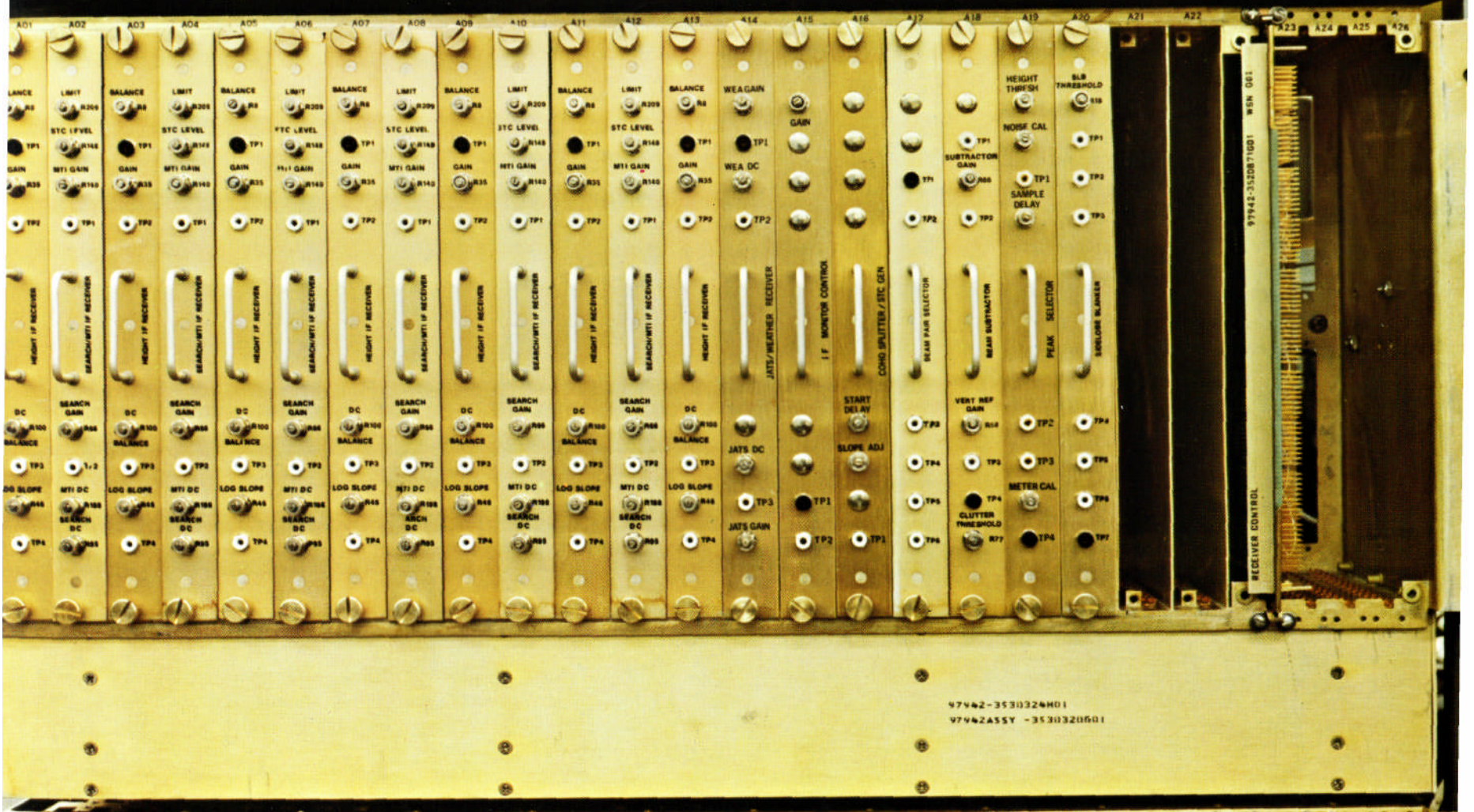
The radar's circuits have been simplified and grouped functionally, making subsystem maintenance easier and reducing its size and weight. An entire search receiver channel is on only one printed circuit card. Total processing circuitry is on just 72 component boards, and there are only 31 board types.

This design not only reduces subsystem complexity and volume, but also lowers spares cost.





OFF-LINE TEST CONTROL



Clutter Rejection Features

The AN/TPS-43E rejects clutter caused by ground reflections or weather, and resists electronic interference caused by jammers. Its clutter rejection features include phase-coded pulses, pulse-to-pulse frequency agility, digital moving target indication (DMTI), and constant false alarm rate (CFAR).

Phase-coded pulse transmission increases target detection capability by decreasing the effects of ground clutter, weather, and chaff. Decoding of the phase-coded return signals improves range resolution, helps negate repeater jammers, and reduces the effect of swept or noise jamming.

Frequency agility, including pulse-to-pulse frequency changes, helps foil repeater jammers, while image-reject mixers attenuate interference from wide-band jammers. Narrow azimuth beamwidth and blanking sidelobe features also help eliminate interference of all types.

A reference channel may be used by the operator to determine when sidelobe blanking is necessary. This channel is also used for **jamming analysis and transmission selection**

(JATS). In this mode, JATS automatically selects the least jammed frequency to reduce the effect of jamming. Weathervideo can also be displayed.

Digital MTI enables the operator to distinguish moving aircraft from ground clutter or chaff. A three-pulse canceller is implemented to provide



Operators enjoy a comparatively "clutter-free" display—a characteristic of the AN/TPS-43E which makes it well-suited for use with automated air defense systems.

up to 30 decibels of MTI improvement, and a staggered pulse-repetition frequency (PRF) eliminates all MTI blind speeds. A digital implementation of MTI has permitted Westinghouse to simplify MTI hardware design and to improve reliability by the extensive use of integrated circuits.

CFAR processing automatically adjusts the level of receiver sensitivity, maintaining a constantly low level of false alarms. This processing helps reject weather clutter and electronic interference and prevents the overloading of indicators and automatic target detection devices in a jamming environment.

integrated logistic Support



Once delivered, Westinghouse can offer a complete integrated logistic support package tailored specifically to meet customer requirements.

Logistic support personnel help make our ground radar systems supportable—and affordable—starting with the initial design. The system is built with reliability and maintainability in mind, with our support plan developing together with the system—logically and systematically. Our designers and logistic experts strike the best balance between high performance and low support cost. It is design-to-cost in its fullest sense... **design to life cycle cost.**

The Westinghouse Integrated Logistic Support Division offers any one or all of the following: management... maintenance engineering ... manuals... training ... test equipment... spares... provisioning data... field operations... field integration services... and support facilities such as complete depots.

Our logistic support program is diverse and flexible. We tailor it to meet your specific needs.

Westinghouse supports AN/TPS-43 radar systems at 54 locations in 8 countries. Soon we will be supporting 120 locations in 12 countries.

We maintain modern classrooms equipped with closed-circuit television in one complete building at our Integrated Logistic Support Division. In adjacent laboratories, students learn how to operate entire ground radar systems, such as the AN/TPS-43E. Our instructors also have taught at many customer locations around the world.

Westinghouse can provide complete, turnkey electronic facilities to repair, maintain, and modify not only ground systems but a full range of electronics equipment.



AN/TPS-43 E Characteristics

Performance	
3-D range	instrumented to 445 km (240 nmi); small target detection to 408 km (220 nmi) (2.5 m ²) Pd = 80%; Pfa = 10 ⁻⁶
Data rate	10 seconds (6 rpm antenna)
Elevation coverage	to 20°
Height accuracy	±457m at 185 km (±1500 ft. at 100 nmi)
Resolution	
Azimuth	1.1°
Range	152 m (500 ft.)
Availability	greater than 95%
Transmitter	
Frequency	S-band
Power output	3.5 MW typical
Frequency modes	fixed, agile, or MTI agility (16 frequencies)
Type	Twystron driven by broadband TWT
Receiver/Processor	
Type and number	seven logarithmic receiver channels (six for receive; one reference channel for sidelobe blanking & JATS)
ECCM	JATS, CPACS, agility, CFAR and PRF stagger
Digital MTI	four separate MTI channels; three-pulse canceller/digital integration; four-pulse cancellers available as plug-in option
MTI improvement factor	30 dB
Antenna	
3-D radar antenna	multiple- (6 beams); 40.6 dB gain
IFF antenna	high resolution ISLS antenna mounted on primary antenna
IFF Equipment	
Interrogator	AN/UPX-23
Decoder	two AN/UPA-59A's
Communications	
UHF	two AN/ARC-164 transceivers with AN/AT-197 antennas
HF	one 618T-2 HF SSB transceiver and its antenna and coupler
Other	six-channel voice intercom; interface for AN/TRC-97 type and troposcatter relay system; interface for AN/TSQ-61 and AN/TSQ-91 shelters
Displays	
PPI	two AN/UPA-62C displays

Small Target Detection

